

CLAIMS

What is claimed is:

1. A method comprising:
 - identifying network elements at endpoints of a data connection channel;
 - generating a candidate path between the network elements at the endpoints;
 - validating the candidate path by determining whether the candidate path provides at least a service requirement selected from a group consisting of minimum bandwidth, maximum bandwidth, maximum delay, maximum jitter, reliability, inclusion of network elements capable of acting as security gateways that bracket untrusted sections of the candidate path, reachability, and data collection capability; and
 - configuring network elements along a validated candidate path to implement the service requirement.
2. The method of claim 1, further comprising:
 - identifying network elements at endpoints of a plurality of data connection channels;
 - for each data connection channel, generating at least one candidate path between the network elements at the endpoints of the data connection channel;
 - for each candidate path, validating the candidate path by determining whether the candidate path provides at least a service requirement selected from a group consisting of minimum bandwidth, maximum bandwidth, maximum delay, maximum jitter, reliability, inclusion of network elements capable of acting as security gateways that bracket untrusted sections of the candidate path, reachability, and data collection capability; and

configuring network elements along validated candidate paths to implement service requirements.

3. The method of claim 1, further comprising recording a configuration performed on the network elements.

4. The method of claim 1, further comprising:
identifying data connection channels that have been provisioned to implement a service;
for each data connection channel, identifying a path followed by the data connection channel and a configuration performed to implement the service at network elements along the path;
undoing the configuration performed to implement the service at the network elements along the path; and
removing a recording of the configuration performed to implement the service on the network elements along the path.

5. The method of claim 1, further comprising:
identifying a change in a routing table entry;
identifying data connection channels provisioned on a data link connected to an interface referenced by the routing table entry prior to the change;
for each data connection channel provisioned on the data link, identifying whether the data connection channel is affected by the change;
for each data connection channel affected by the change, de-provisioning the data connection channel affected by the change; and

for each data connection channel affected by the change, re-provisioning the
data connection channel affected by the change.

6. The method of claim 1, wherein generating a candidate path between the
network elements at the endpoints further comprises assigning to a link in a graph that
is not in a preferred area of a network a weight that is different than a weight assigned
to a link in the graph that is in a preferred area of the network.

7. The method of claim 6, wherein assigning to a link in a graph that is not in a
preferred area of a network a weight that is different than a weight assigned to a link in
the graph that is in a preferred area of the network further comprises adjusting a weight
assigned to a link in the graph depending on a proportion of usage of available
bandwidth of the link.

8. The method of claim 7, wherein adjusting a weight assigned to a link in the
graph depending on a proportion of usage of available bandwidth of the link further
comprises:
adjusting a weight assigned to a link in the graph having lighter usage relative to
other links in the graph to a weight indicating a greater preference; and
adjusting a weight assigned to a link in the graph having heavier usage relative
to other links in the graph to a weight indicating a lesser preference.

9. The method of claim 7, wherein adjusting a weight assigned to a link in the
graph depending on a proportion of usage of available bandwidth of the link further
comprises:
adjusting a weight assigned to a link in the graph having heavier usage relative

to other links in the graph to a weight indicating a greater preference; and
adjusting a weight assigned to a link in the graph having lighter usage relative to
other links in the graph to a weight indicating a lesser preference.

10. A method for a provisioning system comprising:

- a) identifying a candidate path for a newly requested service, the newly requested service having a service description, wherein the newly requested service is in an Internet Protocol (IP) network, the IP network having a plurality of routers, wherein the identified candidate path travels through a set of the plurality of routers;
- b) determining whether the set of the plurality of routers can be configured to meet a set of requirements specified by the service description; and
- c) if the set of the plurality of routers are determined to meet the set of requirements, then translating the set of requirements into a corresponding set of router management commands to configure each router in the set of the plurality of routers.

11. The method of claim 10, further comprising:

- d) identifying a plurality of candidate paths for a newly requested service, the newly requested service having a service description, wherein the newly requested service is in an Internet Protocol (IP) network, the IP network having a plurality of routers, wherein each candidate path of the plurality of candidate paths travels through a subset of the plurality of routers;
- e) for each candidate path, determining whether a subset of the plurality of routers can be configured to meet a set of requirements specified by the service description; and
- f) for each set of requirements, if a subset of the plurality of routers are determined

to meet the set of requirements, then translating the set of requirements into a corresponding set of router management commands to configure each router in the subset of the plurality of routers.

12. The method of claim 10, wherein the set of requirements includes one or more of quality of service, security, reachability, and data collection specifications.

13. The method of claim 10, further comprising:
if the identified candidate path cannot fulfill the set of requirements and there are other untried candidate paths, then identifying a different candidate path and repeating steps b) and c).

14. The method of claim 10, wherein the translating includes querying a network topology database to determine the capabilities of each router of the plurality of routers.

15. A method for a provisioning system comprising:
identifying a set of one or more candidate paths for a newly requested service in an Internet Protocol (IP) network having a plurality of routers, wherein each of the candidate paths travels through a different subset of the plurality of routers, the newly requested service having a service description;
eliminating a candidate path from the set of candidate paths whose corresponding subset of the plurality of routers cannot be configured to meet the set of requirements specified by the service description; and
translating a remaining candidate path into a set of router management commands to configure the subset of the plurality of routers.

1 16. The method of claim 15, wherein the set of requirements includes one or more
2 of quality of service, security, and data collection specifications.

1 17. The method of claim 15, wherein the identifying includes querying a
2 provisioned services database to add together the bandwidth commitments of
3 previously deployed services to determine if each of the candidate paths has sufficient
4 uncommitted bandwidth for the newly requested service.

1 18. A provisioning system comprising:
2 a provisioning engine coupled to a network topology database and a provisioned
3 services database, the provisioning engine to identify candidate paths for newly
4 requested services in a network, each of the newly requested services having a
5 corresponding service description that specifies a corresponding set of requirements,
6 wherein each of the candidate paths are to include a subset of routers of a plurality of
7 routers in the network, wherein the provisioning engine is to determine whether a set of
8 the candidate paths meet the corresponding set of requirements; and

9 a translation module coupled to the provisioning engine, the translation module
10 to translate the set of requirements for a set of candidate paths that meet the
11 corresponding set of requirements, the translation to generate corresponding router
12 management commands to configure routers in the plurality of routers.

1 19. The provisioning system of claim 18, wherein the set of requirements includes
2 one or more of quality of service, security, and data collection specifications.

20. The provisioning system of claim 18, wherein the translation module is to store the configuration of the routers in the provisioned services database.

21. A machine-readable medium that provides instructions that, when executed by a machine, cause the machine to perform operations comprising:

identifying network elements at endpoints of a data connection channel;

generating a candidate path between the network elements at the endpoints;

validating the candidate path by determining whether the candidate path

provides at least a service requirement selected from a group consisting of minimum

bandwidth, maximum bandwidth, maximum delay, maximum jitter, reliability,

inclusion of network elements capable of acting as security gateways that bracket

untrusted sections of the candidate path, and data collection capability; and

configuring network elements along a validated candidate path to implement the service requirement.

22. The machine-readable medium of claim 21, wherein operations further comprise:

identifying network elements at endpoints of a plurality of data connection channels;

for each data connection channel, generating at least one candidate path

between the network elements at the endpoints of the data connection channel;

for each candidate path, validating the candidate path by determining whether

the candidate path provides at least a service requirement selected from a group

consisting of minimum bandwidth, maximum bandwidth, maximum delay, maximum

jitter, reliability, inclusion of network elements capable of acting as security gateways

that bracket untrusted sections of the candidate path, reachability, and data collection capability; and

configuring network elements along validated candidate paths to implement service requirements.

23. The machine-readable medium of claim 21, wherein operations further comprise recording a configuration performed on the network elements.

24. The machine-readable medium of claim 21, wherein operations further comprise:

- identifying data connection channels that have been provisioned to implement a service;
- for each data connection channel, identifying a path followed by the data connection channel and a configuration performed to implement the service at network elements along the path;
- undoing the configuration performed to implement the service at the network elements along the path; and
- removing a recording of the configuration performed to implement the service on the network elements along the path.

25. The machine-readable medium of claim 21, wherein operations further comprise:

- identifying a change in a routing table entry;
- identifying data connection channels provisioned on a data link connected to an interface referenced by the routing table entry prior to the change;

6 for each data connection channel provisioned on the data link, identifying
7 whether the data connection channel is affected by the change;
8 for each data connection channel affected by the change, de-provisioning the
9 data connection channel affected by the change; and
10 for each data connection channel affected by the change, re-provisioning the data
11 connection channel affected by the change.

1 26. The machine-readable medium of claim 21, wherein operations further
2 comprise assigning to a link in a graph that is not in a preferred area of a network a
3 weight that is different than a weight assigned to a link in the graph that is in a
4 preferred area of the network.

1 27. The machine-readable medium of claim 26, wherein assigning to a link in a
2 graph that is not in a preferred area of a network a weight that is different than a weight
3 assigned to a link in the graph that is in a preferred area of the network further
4 comprises adjusting a weight assigned to a link in the graph depending on a proportion
5 of usage of available bandwidth of the link.

1 28. The machine-readable medium of claim 27, wherein adjusting a weight
2 assigned to a link in the graph depending on a proportion of usage of available
3 bandwidth of the link further comprises:
4 adjusting a weight assigned to a link in the graph having lighter usage relative to
5 other links in the graph to a weight indicating a greater preference; and
6 adjusting a weight assigned to a link in the graph having heavier usage relative
7 to other links in the graph to a weight indicating a lesser preference.

29. The machine-readable medium of claim 27, wherein adjusting a weight assigned to a link in the graph depending on a proportion of usage of available bandwidth of the link further comprises:

adjusting a weight assigned to a link in the graph having heavier usage relative to other links in the graph to a weight indicating a greater preference; and

adjusting a weight assigned to a link in the graph having lighter usage relative to other links in the graph to a weight indicating a lesser preference.

30. A machine-readable medium that provides instructions that, when executed by a machine, cause the machine to perform operations comprising:

a) identifying a plurality of candidate paths for a plurality of newly requested services, each one of the newly requested services having a service description, wherein the newly requested services are in an Internet Protocol (IP) network, the IP network having a plurality of routers, wherein the identified candidate path travels through a subset of the plurality of routers;

b) for each service description, determining whether the subset of the plurality of routers can be configured to meet a set of requirements specified by the service description; and

c) for each set of requirements, if the subset of the plurality of routers are determined to meet the set of requirements, then translating the set of requirements into a corresponding set of router management commands to configure each router in the subset of the plurality of routers.

31. The machine-readable medium of claim 30, wherein operations further comprise:

3 d) identifying a plurality of candidate paths for a plurality of newly requested
4 services, each one of the newly requested services having a service description,
5 wherein the newly requested services are in an Internet Protocol (IP) network, the
6 IP network having a plurality of routers, wherein the identified candidate path
7 travels through a subset of the plurality of routers;
8 e) for each service description, determining whether the subset of the plurality of
9 routers can be configured to meet a set of requirements specified by the service
10 description; and
11 f) for each set of requirements, if the subset of the plurality of routers are
12 determined to meet the set of requirements, then translating the set of requirements
13 into a corresponding set of router management commands to configure each router
14 in the subset of the plurality of routers.

1 32. The machine-readable medium of claim 30, wherein the set of requirements
2 includes one or more of quality of service, security, and data collection specifications.

1 33. The machine-readable medium of claim 30, wherein operations further
2 comprise:

3 if the identified candidate path cannot fulfill the set of requirements and there
4 are other untried candidate paths, then identifying a different candidate path and
5 repeating steps b) and c).

1 34. The machine-readable medium of claim 30, wherein the translating includes
2 querying a network topology database to determine the capabilities of each router of the
3 plurality of routers.

